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Carbonate factories: Sediment production, export and platform development.

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Over the last decades several concepts have been developed linking different types of carbonate biota with variations in sediment production and -export. The carbonate factory theory (Schlager, 2000) is one of those concepts, describing variations in terms of skeletal and non-skeletal carbonate production and their global distribution related to fluctuations in water temperature, light and nutrient input.

The three factories distinguished are (1) the tropical T-factory where light, high water temperatures and depleted nutrient levels play a decisive role, (2) the cool water C-factory which relates to low water temperatures and high nutrient levels, and (3) the microbial dominated M-factory that is adapted to varying nutrient levels and water temperatures. Recently a fourth factory type was added, the cold-water coral factory (CWC factory) combining deep water environments with low water temperatures and high nutrient input.

The four factories not only show different carbonate production profiles, but also display different carbonate sediment export patterns related to their specific carbonate sediment production windows. Each factory responds in a specific manner to climate and sea-level induced variations through time, with highstand shedding for the T-factory (Schlager et al., 1994) and slope shedding for the M-Factory (Kenter et al., 2005) as the most well-known sediment export patterns. The C-factory sediment export patterns show large similarity to the siliciclastic type of sediment export patterns in response to sea-level fluctuation because of the low diagenetic character of their sediments (Schlager, 2005). The CWC factory shows sediment production and export dependent on the influx of nutrients feeding the system, which in turn relates to variations in deep-ocean currents steered by sea-level fluctuations and large-scale tectonic processes changing ocean circulation patterns.

Not only the sediment export patterns are system-dependent, but also the curvature of the bordering carbonate slopes is (Schlager & Reijmer, 2009; Adams & Kenter, 2013), with an exponential profile for T-factories, a Gaussian profile for C-factories, and a linear profile for M-factory systems. Slopes of CWC factories depend on the growth strategy of the individual systems, though most are very steep. In addition, it needs to be mentioned that all slope systems depend not only on the changes in grain size production inherent to each system but also to stabilization by organic frame-building organisms (Reolid et al., 2017), current activity (Betzler et al., 2014), and system-related cementation of the slope deposits (Grammer et al., 1999; van der Kooij et al., 2010).

Recent research on slope sedimentation patterns shows major advances in our understanding of slope destabilization processes, syn-sedimentary deformation patterns and gully formation processes. In addition, our understanding of sediment distribution patterns on the slopes, sediment redistribution mechanisms and sediment transport to deep-ocean basins has increased significantly because of visualization tools that can be utilized nowadays when mapping deep-water systems.

In conclusion, the understanding of the specific character of carbonate factories and associated sedimentation patterns becomes more and more important when assessing the possibilities of a system to respond to spatial and temporal changes in the marine environment.